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ABSTRACT

Addressing theoretical and methodological issues, the present study assessed the content, accuracy, and consistency of school-aged children's memories of a potentially emotional, historic event: the explosion of the Space Shuttle Challenger on January 28, 1986. A total of 345 children in kindergarten through eighth grade were tested. To examine the effects of delay and rehearsal, half were seen at intervals of 2 weeks and 2 months after the event, and half at the later time only. At the earlier time, half of the children were asked to recall freely, and were not prompted to give specific personal and factual information. Others were prompted. Free recall reports were scored according to Brown and Kulik's (1977) guidelines. The prompted recall protocols were scored for accuracy and uncertainty. In addition, answers to all questions for children who were tested twice were coded for consistency. Results suggested that children's memories for the event were not vivid, lasting, or consistent. Some of the younger children gave obviously false reports, and contradicted their earlier accounts at the later testing. It is concluded that the findings do not rule out a physiological explanation for the children's "flashbulb" memories. Physiological factors may have played a minor role in observed age differences in recall. (RH)

Flashbulb Memory Revisited:

Children Recall the Space Shuttle Accident

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"Flashbulb" Memory Revisited: Children Recall the Space Shuttle Accident

The term "flashbulb memory" was coined by Brown and Kulik (1977) to describe the vivid and apparently permanent recall for irrelevant, personal information associated with significant historic, emotional events (e.g., Kennedy's assassination). The "flashbulb" memory consisted of six "core" items, including how they had first heard the news (informant); where they were at the time (place), what they were doing (activity), how they felt about it at the time (own affect), how others felt (other affect), and what had happened immediately afterwards (aftermath). These researchers favored a physiological explanation for such memories, arguing that the extreme emotional arousal activated a "now-print" mechanism which printed all ongoing sensory and cognitive processes directly into long-term memory, bypassing the limited capacity short-term store and any attentional filters. Thus, even seemingly irrelevant information is saved along with the factual information about the event itself, because no conscious monitoring of the salience of information occurred. Their view receives some support from the work on H.M. Although H.M. supposedly could not transfer any information form short- to long-term memory, he could recall his father's and Kennedy's deaths, perhaps due to the "now-print" mechanism which bypassed the damaged part of his system.

Neisser (1982), on the other hand, argued that these memories are reconstructed from a general "schema" for such events that provides a landmark by which the individual can place him/herself in historical time. Rather than flashbulbs, they may be "benchmarks" in personal and social history. Such a schema, Neisser argues, would be similar to the way one reports on the factual event itself, who, what, where, when and why; and thus would most likely

include some of the very core items described by Brown & Kulik (1977), such as who (told you), what (were you doing), where (were you) and the like. Perhaps young children have not yet developed such a schema and therefore will not have flashbulb memories for historical events. Winograd & Killinger (1983) found that their adult subjects, who ranged in age from one to seven years at the time of Kennedy's death, all had vivid and detailed memories for the first time they heard the news. However, there was a steep gradient for elaboration of the recall depending on the age at encoding. Those who had been older at the time of the event remembered more. Even though the event had occurred many years earlier, and these adult subjects could have since developed a schema from which they could have totally reconstructed inaccurate "flashbulb" memories, Winograd & Killinger suggested that the age dependency in their data reflects true differences in the original encoding, and that some central core of the memory may remain accurate even while certain aspects are undergoing recoding and reconstruction over time. For example, it was interesting that almost all their subjects could remember where they were and what they were doing when they heard the news, but there was great variability in their memory for the informant and aftermath. The age differences may be accounted for in many ways. First, the physiology of memory may actually change, such that the now-print mechanism is only operable in older children. Second, only the older children may have understood the significance of such an historic event, so that they were the only ones who were emotionally affected, and the emotion produced the flashbulb effect. On the other hand, possibly only the older children had fully developed the schema for recalling such events, and their greater elaboration actually reflects a more elaborate schema.

In all previous studies of flashbulb memories, researchers have examined such memories retrospectively and reflectively, asking adults to think back to when the event occurred. Moreover, they have not asked for retellings of the

memory at any later date than the one time tested, so no change over time in the memory may be directly investigated. It would be more useful to collect children's memories shortly after an event rather than waiting until they are adults, and also to retest their memories at some later date to look for changes. Secondly, Winograd & Killinger, attempting to avoid the problems encountered by Brown & Kulik in coding their free recall reports, simply directly asked for the six "core" pieces of information, thus prompting their subjects on what important pieces they should remember. In fact, on their overall instruction sheet, they mentioned that "some people know exactly where they were and what they were doing when they heard the news". These instructions were used to guide the subjects into presenting personal, event discovery information rather than specific factual event information, but they may have had the undesirable side effect of biasing subjects to report their location and activity even when they were unsure of it. Finally, no previous investigator appears to have been interested in subjects' memories about the factual event information itself. It is possible that more emotional reaction leads both to more personal and factual information, or that greater emotion leads the subject to seek out more factual information on the topic.

The present study was designed to address the above issues by assessing the content, accuracy, and consistency of school-aged children's memories for a potentially emotional, historic event, the expolsion of the Space Shuttle Challenger on January 28th, 1986. This event was thought to have profound effects on children, as they more closely identified with the event due to the schoolteacher member of the crew, and the fact that many school lessons included TV coverage of the mission.

METHOD

345 children in kindergarten through eighth grade were tested; half at

both two weeks and two months after the event, the other half only at time 2; in order to examine the effects of delay and rehearsal. Moreover, at Time 1, half the children were given only the free recall reports without the prompting, specific questions. Children in kindergarten through second grade were tested orally, while all older children were instructed to answer the questions in written form. The free recall reports (I want you to tell me everything you can remember about when you first heard about the space shuttle exploding) were scored according to Brown and Kulik's guidelines (1 point given for each of the six core items mentioned). The prompted recall protocols contained specific questions on personal information (e.g., "Where were you when you first heard about the Space Shuttle accident") and factual questions ("What was the name of the Space Shuttle that exploded?"), which were scored for accuracy. The personal discovery questions were also scored for any evidence of uncertainty or "hedging", such as answering "I was probably at home in the den" to the question "Where were you?". In addition, the answers to all questions for children who were twice tested were coded for consistency. If the gist of the free recall report was the same at both times, the child was said to be consistent. For example, if at Time 1 a child reported that they had been at home watching TV with their mother when they heard, then at Time 2 said that they had been at home watching TV, we scored the reports as consistent. Moreover, to receive a point for consistency, the child had to have provided an answer at both times (in other words, lack of response at both times was not scored as consistent). The answers to the prompted and factual questions were also scored in this fashion. Inter-coder agreement was calculated to be 90%, which closely matches the reliability reported by Brown and Kulik (1977, 90%) and Winograd & Killinger (1983, 89%).

RESULTS AND DISCUSSION

An analysis of variance with grade/age as the grouping variable and the Brown and Kulik scores (Times 1 & 2) on the free report as the dependent variables revealed significant grade (F (8,159) = 7.89, $p<.0001$) and time of testing (F (1,159) = 55.39, $p<.0001$) main effects, as well as a significant interaction ($F(8,159) = 2.42$, $p<.02$). In general, older children received higher "flashbulb" scores than younger children; and the Time 1 reports were more vivid and detailed than the Time 2 reports. However, the Time 2 scores were significantly lower than Time 1 scores only for selected grade levels: Kindergarten and 5th, 6th, 7th and 8th grades (see Table 1). Perhaps this is due to a floor effect for the younger children (with the exception of the kindergartners). The analyses of rehearsal effects on the Time 2 reports only indicated that older children scored higher than younger children (Grade main effect $F(8,317) = 7.85$, $p<.0001$) and retested children scored higher than once tested children (F (2,317) = 12.53, $p<.0001$, see Table 2). Moreover, there was a trend of interaction between grade and group (retested versus new), which indicated that the group differences were largest for the older children [$F(16,317)=1.61$, $p<.06$].

Other analyses were conducted to compare the two different retested groups: those only asked for free recall at time 1, and those asked for both free recall and prompted, specific questions (See Design Appendix). Our hypothesis was that if younger children recall less because they do not have a script or schema to aid them, providing them with a schema at time 1 (by asking for specific, "core" items) might enhance their free recall at time 2. An analysis of variance on the time 2 free recall scores with condition and grade as the grouping variable (new, retested-free only, retested-prompt) revealed significant ($p<.0001$) main effects of grade level and group as well as an interaction ($p<.03$). In general, the prompted group outperformed the retested - free recall only group, which in turn outperformed the new group

(see Table 3). However, contrary to prediction, the prompting enhanced recall more for the older children than the younger children. Looking at both time 1 and time 2 scores for the two retested groups, we found significant main effects of grade and time of testing, as well as significant interactions of time by grade ($p<.05$) and time by group ($p<.003$). The time by group interaction resulted from the fact that the recall of the prompted group generally declined less by time 2 than the free recall only group (Table 4).

The fact that Time 2 reports were lower than Time 1 reports in general leads to doubt on the "permanency" of flashbulb memories. The consistency scores for children tested at both times also lead us to doubt that all children have permanent, non-reconstructed memories for this event. We conducted X^2 analyses on the consistency scores for each question by grade level. The results of this analysis for the consistency of free recall scores revealed that in all grades, the majority of children (60% or more) were inconsistent in the gist of their time 1 and time 2 reports. Consistency scores for specific, personal discovery items were higher (for informant, and location, better than 80% of the children were consistent, whereas for activity the consistency rate was approximately 60%).

Turning to the prompted, specific questions, no grade differences were found for the question concerning where the child was when he/she heard the news. This supports Winograd & Killinger's earlier finding. However, there were significant grade and group effects for the activity question. Unsurprisingly, analyses also indicated that age was significantly related to recall of factual information (significant X^2 for grade on what day, date, month, time of day, name of shuttle, and number of crew were found), but age per se may not be responsible for better recall, as older children also reported that they had seen the accident on television more times. However,

this cannot account for the times of testing effects reported earlier, as no significant differences existed in reported TV viewings for once and twice tested children.

Two months after the event, only the oldest children (7th and 8th graders) who had rehearsed appeared to have anything like "flashbulb" memories. This may be due to what Winograd & Killenger call the "disruption hypothesis". They found that the typical memory for their subjects involved a normal school day being disrupted by news of Kennedy's shooting either broadcasted over the intercom or by someone bursting into the room to tell them. Then normal activities ceased, many teachers cried, and many children were sent home from school early. All these factors enhanced the intial significance of the event itself. The seventh graders in this study were particularly "disrupted", as a fire in the school cafeteria led to the early termination of lunch. Upon returning in confusion tc the room, they learned of the space shuttle explosion. However, this cannot explain why the seventh graders tested at Time 2 only could not recall as much of this information. Winograd & Killinger also report that older adults recalling the attack on Pearl Harbor did not experience significant disruption of their routines (a sleepy Sunday afternoon spent playing alone and listening to the radio when the broadcast was disrupted). Moreover, many of the teachers of the earlier grades reported that they told the children that afternoon, said prayers for the astronauts, and did disrupt schedules. However, it did not appear to enhance recall.

Another possiblity for the low recall scores of the third and fourth grade children may be in the way that these questions were administered. Kindergartners through second graders were questioned orally and the tape recorded responses were later transcribed. All older children wrote their own

responses. Thus, there may be a lowered estimate of the recall for third or fourth graders who had difficulty in writing lengthy or detailed reponses. Also, all children may have recalled more information than that which we credited to them, but it may not have fallen into one of the six core categories. We are in the process of analyzing the total number of details reported, regardless of the category.

One factor that may account for some of the observed age differences in recall is the informant, in that older children were more likley to report that they had been told by someone, whereas younger children and those being tested only at time 2 more often reported hearing it first from the media. An analysis of variance using grade level (young, middle, older being K-2, 3-5, and 6-8 respectively) and informant (person versus media) as the grouping variables and free recall time 2 as the dependent measure revealed significant ($p<.00001$) main effects of grade level and informant, but no interaction. Older children and those who reported hearing the news first from a person had higher recall scores (see Table 5). However, it should be kept in mind that some children changed their minds about the original source of their information at time 2, so the time 2 informant could well be inaccurate. In fact, a similar, but repeated measures analysis of variance using free recall from both times of testing and informant time 1 and grade level as grouping variables yielded an extremely complex and generally uninformative pattern of results. Significant ($p<.0001$) main effects of grade and time were noted, as well as a significant interaction between informant, grade, and time ($p<.02$).

In summary, our results suggest that children's memories for this event were not vivid, lasting, or consistent. Some of the younger children gave obviously false reports, such as "My father was on the Shuttle", and many

contradicted their earlier accounts at the later testing. If as adults, these same children remember this event vividly, it might be through reconstruction after they have learned of the event's significance. These results do not rule out a physiological explanation for flashbulb memories. If the younger children did not understand the significance of the event, then they may not have met the precondition of "consequentiality" (realization of the impact the event will have on the person discovering it), which Brown & Kulik (1977) might argue would reduce the emotional arousal and thus fail to activate the "now-print" mechanism. It is also possible that the younger children do remember the event, but do not yet have the linguistic abilities needed to express it adequately. For example, almost all the younger children reported feeling "sad" upon hearing the news, whereas older children reported a broad range of feelings, from anger to fear to shock to disbelief. Lastly, it is possible that physiological factors played a minor role in the observed age differences in recall. Perhaps the older children were drawing upon a well-organized and practiced script in reporting their discovery of this information, while younger children had no script for this type of event.

TABLE 1

Brown & Kulik scoring for Free Recall Reports: Same children recalling the event at two weeks and two months afterwards (Mean recall score of 6 total possible core items)

Grade:	KG	1st	2nd	3rd	4th	5th	6th	7th	8th
Time 1	2.13	1.45	2.54	1.78	1.60	2.06	2.67	3.30	4.07
Time 2	.56	1.05	1.85	1.43	1.24	1.25	1.57	2.75	2.21

TABLE 2

Brown & Kulik scoring for Free Recall Reports: Time 2 reports only Group 1 (repeating the recall task) and Group 2 (first time of testing)

Grade:	Kinder-Second	Third-Fifth	Sixth-Eighth
Group 1 (repeat)	1.10	1.31	2.16
Group 2 (new)	.81	1.00	1.07

TABLE 3

Age versus Group on Time 2 Free Recall Scores

Group		New	Free	Prompt
AGE				
Young	M=	.81	.96	1.24
	SD=	(1.23)	(1.31)	(1.27)
Middle		1.0	1.19	1.44
		(1.05)	(.97)	(1.11)
Older		1.07	1.73	2.55
		(1.07)	(1.34)	(1.53)

New = Tested Time 2 only; Free = Tested T1 & 2, Free recall only at T1, Prompted = Tested both T1 & T2 on both Free and Prompted recall

TABLE 4

Retested Groups: Prompted and Not Prompted at Time 1

	Time 1	Time 2
Young		
Free	2.00	.96
Prompted	1.92	1.25
Middle		
Free	1.84	1.19
Prompted	1.72	1.44
Older		
Free	3.50	1.73
Prompted	3.03	2.55

TABLE 5

Age and Informant Effects on Time 2 Recall Scores

	Informant	
AGE	Person	Media
Young	1.33	.70
Middle	1.17	1.08
Older	1.65	1.33

DESIGN

Group	Time 1	(2 month lag)	Time 2
A	Free recall		Free recall
	Prompted "		Prompted "
B	Free recall		Free recall
			Prompted "
C			Free recall
			Prompted "

FREE RECALL PROTOCOL

Name ....

Grade..... Age..... Sex.....

How did you find out about the shuttle accident for the very first time?

Did somebody tell you about it, or did you hear about it on the radio or TV?

How many times have you seen the explosion on TV?

Please write down everything you can remember about when you very first heard about or saw the shuttle exploding.

PROMPTED RECALL

Name.....

Please answer these questions as well as you can. If you are not sure about an answer, leave it blank or just write I don't know. This is not a test, we just want to see what people can remember.

1. Where were you when you heard about the shuttle exploding?

2. What were you doing when you heard about it?

3. What were you wearing?

4. How did you feel when you heard about it?

5. What day did the accident happen? (Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, or Sunday?)

6. What day of the month did the accident happen?

7. What time of the day did the accident happen?

8. What was the weather like here on the day the accident happened?

9. What was the name of the space shuttle?

10. How many people were there on the shuttle?

11. Can you remember anything about the people on the shuttle? Do you know any of their names, or what their jobs were, or what they looked like?